What Is Claimed Is:

1. A calibration apparatus of transmission links for array antenna. The array antenna transmission link includes array transmitter, n of power amplifiers, n of uplink and downlink signal separating apparatuses, and n of antenna units. Array transmitter, n of power amplifier and n of uplink and downlink signal separating apparatuses are placed in base station, the output of base band signal processing module is inputted into array transmitter, n channels of signal are transmitted by the array transmitter, after going through power amplifier and uplink and downlink signals separating apparatus, they are transmitted through the antenna; the characteristic is

The calibration equipment includes power detecting signal separating apparatus, power detecting signal feeder apparatus, power detecting apparatus, signal synthesizing apparatus and array calibration apparatus; wherein

The power detecting signal separating apparatus, receives the signal from the separating apparatus of uplink and downlink signals, filters out the DC signal from the RF signal, and transmits the RF signal of high frequency to the power detecting signal feeder apparatus; at the same time, recovers the power signal from the signal transmitted by the power detecting signal feeder apparatus, does the adjust of calibration weight, and transmits the calibration weight after adjustment to the array calibration apparatus;

The power detecting signal feeder apparatus, on one side, transmits the high frequency RF signal outputted by power detecting signal separating apparatus, on the other side, mixes the power signal outputted by power detecting apparatus and high frequency RF signal, and transmits the mixed signal to the power detecting signal separating apparatus;

The power detecting apparatus, is used to detect the power of RF signal coming from the signal synthesizing apparatus, and outputs the power signal to the power detecting signal feeder apparatus;

The signal synthesizing apparatus is coupled with n of antenna units, used to synthesize RF signal and output to the power detecting apparatus;

The array calibration apparatus, placed between the base band signal processing module and array transmitter, is used to calibrate the array antenna transmission link according to the adjusted calibration weight.

2. The calibration apparatus of transmission links for array antenna according to claim 1, the characteristic is, the signal synthesizing apparatus, signal power detecting apparatus, and power detecting signal feeder apparatus can form an outdoor unit with n of antenna units, outdoor unit is connected with base station via RF cable.

3. The calibration apparatus of transmission links for array antenna according to claim 1, the characteristic is, the signal synthesizing apparatus includes Bulter matrix, (n-1) of couplers, (n-1) of filters and (n-1) of adjustable attenuators, wherein coupler, filter and adjustable attenuator will be provided in the first (n-1) of transmission links. The coupler, is used to separate a small part of RF signal from the RF beam signal formed Bulter matrix; the separated RF signal will be filtered by filter and attenuated by adjustable attenuator, then sent to the signal power detecting apparatus.

4. The calibration apparatus of transmission links for array antenna according to claim 3, the characteristic is, the attenuation of source RF signal caused by the separated small part of RF signal should not exceed 1 dB.

5. The calibration apparatus of transmission links for array antenna according to claim 3, the characteristic is, the signal power detecting apparatus is comprised of (n-1) of detectors and (n-1) of amplifiers, corresponding to first (n-1) of transmission links; the RF signal of first (n-1) of transmission links will form power signal after detecting and amplifying processing, it is outputted to power detecting signal feeder apparatus.

6. The calibration apparatus of transmission links for array antenna according to claim 3, the characteristic is, the power detecting signal feeder apparatus includes n of signal feeder units, corresponding to n of transmission links, respectively, each of signal feeder units includes: inductive circuit L, capacity circuit C1 and capacity circuit C2;

for the signal feeder unit of the first transmission link to the $(n-1)^{th}$ transmission link, wherein inductive circuit L is used to mix the low frequency signal of power signal with the high frequency RF signal, capacity circuit C2 is used to filter the high frequency part of power signal, capacity circuit C1 is used to prevent sending the low frequency signal of power detecting signal to antenna units;

while the inductive circuit L in the n^{th} transmission link is used to separate the power supply signal from the high frequency RF signal, capacity circuit C2 is used to filter the high frequency part of power supply signal, capacity circuit C1 is used to prevent sending the power supply signal to antenna units.

7. The calibration apparatus of transmission links for array antenna according to claim 3, the characteristic is, the power detecting signal separating apparatus includes n of inductive circuits L, n of capacity circuits C3, n of capacity circuits C4, (n-1) of A/D converters and calibration weight calculating apparatus, wherein the n^{th} transmission link does not have A/D converter;

for the first to the $(n-1)^{th}$ transmission links, inductive circuit L is used to separate the power signal from mixed signal; capacity circuit C4 is used to filter the high frequency part of power signal; capacity circuit C3 is used to prevent sending the power signal to uplink and downlink signal separating apparatus of corresponding transmission link;

while for the n^{th} transmission link, inductive circuit L is used to mix the power supply signal with the high frequency RF signal; capacity circuit C4 is used to filter the high frequency part of power supply signal; capacity circuit C3 is used to prevent sending power supply signal to the n^{th} uplink and downlink signal separating apparatus;

the A/D converter, is used to perform the A/D converting for the low frequency power signal, and transmit it to calibration weight calculating apparatus;

the calibration weight calculating apparatus, is used to adjust the calibration weight according to the value of received power signal.

8. The calibration apparatus of transmission links for array antenna according to claim

1, the characteristic is, the signal synthesizing apparatus is comprised of n of couplers, n of filters and one signal synthesizer with n channels; the coupler is used to separate a small part of RF signal from high frequency RF signal outputted by the power detecting signal feeder apparatus; the separated RF signal is sent to synthesizer after the processing of the filter, then the RF signal after synthesizing will be outputted to power detecting apparatus.

9. The calibration apparatus of transmission links for array antenna according to claim 8, the characteristic is, the power detecting apparatus is comprised of a detector and a amplifier; synthesized RF signal will form power signal through the processing of the detector and the amplifier, and be sent to power detecting signal feeder apparatus.

10. The calibration apparatus of transmission links for array antenna according to claim 8, the characteristic is, the power detecting signal feeder apparatus includes inductive circuit L, capacity circuit C1 and capacity circuit C2 in any one of the first (n-1) transmission links and the n^{th} transmission link; wherein

the inductive circuit L in any one of the first (n-1) transmission links is used to mix the low frequency signal of power signal with high frequency RF signal, the mixed signal after mixing is transmitted to the power detecting signal separating in the base station; apparatus capacity circuit C2 is used to filter the high frequency part of power signal; capacity circuit C1 is used to prevent sending the low frequency signal in power signal to antenna units;

the inductive circuit L of the n^{th} transmission link is used to separate the power supply signal from high frequency RF signal; capacity circuit C2 is used to filter the high frequency part of power supply signal; capacity circuit C1 is used to prevent sending the power supply signal to antenna units.

11. The calibration apparatus of transmission links for array antenna according to claim 8, the characteristic is, the power detecting signal separating apparatus includes inductive circuit L, capacity circuit C3 and capacity circuit C4 in any one transmission link corresponding to which is chosen in the power detecting signal feeder apparatus and the n^{th} transmission link, as well as A/D converter and calibration weight calculation apparatus; wherein

inductive circuit L of any one transmission link is used to separate the power signal from the mixed signal, capacity circuit C4 is used to filter the high frequency part of power signal, capacity circuit C3 is used to prevent sending the power signal to first uplink and downlink signal separating apparatus;

while inductive circuit L of the n^{th} transmission link is used to mix the power supply signal with high frequency RF signal; capacity circuit C4 is used to filter the high frequency part of power supply signal; capacity circuit C3 is used to prevent sending the power supply signal to the n^{th} uplink and downlink signal separating apparatus;

the A/D converter, is used to perform the A/D converting for the low frequency power signal, and transmit it to calibration weight calculating apparatus;

the calibration weight calculating apparatus, is used to adjust the calibration weight according to the value of received power signal.

12. A calibration method of transmission links for array antenna, the characteristic is, comprises below steps: first, get the initial values of gain calibration weight and phase calibration weight of transmission link; then calculate the gain calibration weight and phase calibration weight of transmission link; calibrate the gain and phase of array transmission link using the above calculated calibration weight.

13. The calibration method of transmission links for array antenna according to claim 12, the characteristic is, the step to get the initial values of gain calibration weight and phase calibration weight of transmission link, further comprises: control the base band signal and make the base station only having one channel sending signal; adjust the gain calibration weight for this link, and make the transmitting power of this link meet the rating value; then the gain calibration weight at this time is the initial value of the gain calibration weight for this link; perform the above operation for all of the transmission links in the base station, to get the initial value of gain calibration weight for each transmission link.

14. The calibration method of transmission links for array antenna according to claim 12, the characteristic is, the step to get the initial values of gain calibration weight and

phase calibration weight of transmission link, further comprises: firstly, control all of the transmission link to send signal with same phase in base band, then select the first transmission link as the reference channel, the other channel as the channel to be calibrated, adjust the phase of transmitting signal for the calibrating channel, make the signal power of first antenna unit is at maximum, and the signal powers of other antenna unit are at minimum, save the phase adjusting coefficient of transmission link at this time, which is represented by vector $\lfloor 0 \quad \phi_{adj1} \quad \cdots \quad \phi_{adjn} \rfloor$, then calculate the inverse matrix W_{but}^{H} or W_{but}^{-1} of the equivalent transmission coefficient matrix of Bulter matrix, and choose the first line vector of the above inverse matrix, which is respected by $V_{bulter,1} = \lfloor \phi_{1,1} \quad \phi_{1,2} \quad \cdots \quad \phi_{1,n} \rfloor$, then the initial value of phase calibration weight for transmission link is $\left[\frac{0}{\phi_{1,1}} \quad \frac{\phi_{adj2}}{\phi_{1,2}} \quad \cdots \quad \frac{\phi_{adjn}}{\phi_{1,n}} \right]$.

15. The calibration method of transmission links for array antenna according to claim 12, the characteristic is, the step to get the initial values of gain calibration weight and phase calibration weight of transmission link, further comprises: firstly, choose a transmission link as reference channel, the other transmission links as reference channels, control the reference channel and one of the channel to be calibrated to sending signal simultaneously, adjust the phase of base band signal in the channel to be calibrated, make the power of synthesized signal of the signals transmitted by the two channel at minimum, then the conjugate of the phase adjusting coefficient for the channel to be calibrated is the initial value of phase calibration weight for this channel; choose another channel to be calibrated, repeat the depicted operation, until get the initial values of phase calibration weight for all of the transmission links.

16. The calibration method of transmission links for array antenna according to claim 12, the characteristic is, the step to calculate the gain calibration weight of transmission link and adjust gain, further comprises: take rating transmission power as the base power value for the calibration, then use dichotomy method to calculate the transmission gain calibration weight of each transmission link, adjust the gain of the transmission link according to calculated gain calibration weight, until the transmission power of each transmission link all meet the requested transmission power.

17. The calibration method of transmission links for array antenna according to claim 16, the characteristic is, the step to calculate the gain calibration weight of transmission link and adjust gain, specifically comprises:

step 1) set the transmission link number NumCh =1;

step 2) judge whether the link number NumCh is larger than the transmission link number of array antenna, if link number is larger than transmission link number, then the gain calibration is end;

step 3) if link number is less than or equal to the transmission link number, then control the transmit signal of $NumCh^{th}$ transmission link in base band;

step 4) detect the power of transmission signal, generate power signal;

step 5) perform the A/D converting for above depicted power signal, get the power of transmission signal;

step 6) judge whether the absolute value of the difference between this power and rating power is less than permitted error, if it is less than permitted error, then add current transmission link number with 1, and loop back to step 2);

step 7) if the absolute value of the difference is larger or equal to permitted error, then judge whether it can continue the calibration, if the calibration can be continued, then adjust the gain calibration weight of this transmission link using dichotomy, then calibrate the $NumCh^{th}$ transmission link according to the updated gain calibration weight, then loop back to step 2);

step 8) if it can not continue the calibration, then prompt the failure of the calibration of the $NumCh^{th}$ transmission link, and end the gain calibration of transmission link.

18. The calibration method of transmission links for array antenna according to claim 17, the characteristic is, the step to judge whether it can continue the calibration in step 7) further comprise: judge whether the iterative number of dichotomy exceeds the setting number, if it exceeds then assume that it can not continue the calibration; if it

does not exceed the setting number, so further judge gain calibration weight is at maximum or the weight values for the contiguous twice dichotomy are same, if gain calibration weight is at maximum or the weight values for the contiguous twice dichotomy are same, then it assumes that the calibration can not be continued.

19. The calibration method of transmission links for array antenna according to claim 14, the characteristic is, the step to calculate the phase calibration weight of transmission link and adjust phase, further comprises: choose any one of the line vector $V_{bulter,i} = \{\phi_{i,1} \quad \phi_{i,2} \quad \cdots \quad \phi_{i,n}\}$ from one of the conjugate matrix or inverse matrix of the equivalent weight coefficient matrix of the transmission link for Bulter matrix as a set of beam weight, weight each channel's signal, then use Bulter matrix for RF beam forming, use direct searching method to adjust this set of beam weight continuously, until the signal after Bulter matrix beam forming only has signal output at the i^{th} antenna unit port, and there is no signal output at the other antenna unit port, at that time the beam weight of the transmission link is marked as $\{w_1 \quad w_2 \quad \cdots \quad w_n\}$, then the final phase calibration weight of transmission link is $W_{PHASE} = \left\{\frac{w_1}{\phi_{i,1}} \quad \frac{w_2}{\phi_{i,2}} \quad \cdots \quad \frac{w_n}{\phi_{i,n}}\right\}$.

20. The calibration method of transmission links for array antenna according to claim 19, the characteristic is, the step to calculate the phase calibration weight of transmission link and adjust phase, specifically comprises:

step 1) set the transmission link number NumCh =1, set the initial value of phase calibration weight Wphase(0)=[0 ,0 ,... ,0], the maximum loop number is M, the loop variation loop's initial value is 0;

step 2) control the transmission signal of all of the transmission link at base band;

step 3) detect the power of transmission signal, form the power signal;

step 4) perform the A/D converting for above depicted power signal, and get the power of transmission signal, save this power value;

step 5) add the phase calibration weight of the NumChth transmission link with 1, judge whether the phase calibration weight of the NumChth transmission link exceeds the value range of phase calibration weight; if it does not exceed the value range, then calibrate the phase of the NumChth transmission link, and loop back to step 3);

step 6) if it exceeds the value range, then judge whether the variation range of the power of the transmission signal meets the request, if it does not meet, then prompt the failure of the phase calibration of the NumChth transmission link;

step 7) if it meets the request, then record the phase calibration weight corresponding to the maximum value of transmission signal power, add the transmission link number with 1, then judge whether the transmission link number exceeds the number of transmission links of array antenna, if it does not exceed, then loop back to step 3);

step 8) if it exceeds the number of transmission links of array antenna, then set transmission link number NumCh as 1, add the loop variation with 1, phase calibration weight Wphase(loop)=[w(1) , w(2) , ... , w(n)] is the phase calibration weight corresponding to the maximum value of power of transmission signal;

step 9) judge whether the current calibration weight Wphase(loop) is same as the calibration weight Wphase(loop-1) of last time, if they are same, then it means the phase calibration of transmission link successes, modify the calculated phase calibration weight using the first line vector $V_{bulter,1}$ of the inverse matrix of the transmission link's equivalent weight coefficient matrix for Bulter matrix, that is, $W_{PHASE} = W_{PHASE}(loop)/V_{bulter,1}$, the phase calibration is end;

step 10) if they are not same, then judge whether the loop variation loop is larger than the maximum loop number M, if it is true, then prompt the failure of phase calibration of transmission link, the phase calibration is end, otherwise loop back to step 3).

21. The calibration method of transmission links for array antenna according to claim 15, the characteristic is, the step to calculate the phase calibration weight of

transmission link and adjust phase, further comprises: take any one of the transmission link of array antenna as a benchmark, then adjust the phase of other transmission links using algorithm, make the intensity of the synthesized signal reach maximum, then the corresponding vector $W_{PHASE} = [1 \quad e^{j\beta_2} \quad \cdots \quad e^{j\beta_n}]^T = [1 \quad e^{j(\phi_1-\phi_2)} \quad \cdots \quad e^{j(\phi_1-\phi_n)}]^T$ is the calibration weight of the transmission link for the array antenna, wherein ϕ_n stands for the phase of the n^{th} transmission link, T stands for transpose operation.

22. The calibration method of transmission links for array antenna according to claim 21, the characteristic is, the step to calculate the phase calibration weight of transmission link and adjust phase, specifically comprises:

step 1) set the transmission link number NumCh =2, set the initial value of the phase calibration weight of all of the transmission links as 0, that is Wphase=[0 , 0 , ... , 0];

step 2) judge whether the transmission link number NumCh is less than or equal to the transmission link number in the array, if it is larger than transmission link number, then this phase calibration of transmission link is end;

step 3) if it is less than or equal to transmission link number, then control the transmission signal in first transmission line and $NumCh^{th}$ transmission link in base band;

step 4) detect the power of transmission signal, form the power signal;

step 5) perform the A/D conversion for above power signal, get the power of the transmission signal, and store this power value;

step 6) add the phase calibration weight of $NumCh^{th}$ transmission link with 1, judge whether the phase calibration weight of $NumCh^{th}$ transmission link is less than or equal to the value range of phase calibration weight, if it is less than or equal to the value range, then calibrate the phase of $NumCh^{th}$ transmission link, then loop back step 2);

step 7) if it is larger than value range, then judge whether the variation range of transmission signal power can meet the request, if it can not meet the request, then prompt the failure of the phase calibration of $NumCh^{th}$ transmission link;

step 8) if it meets the request, then record the phase calibration weight corresponding to the maximum value of transmission signal power, then add the transmission link number with 1, loop back to step 2).